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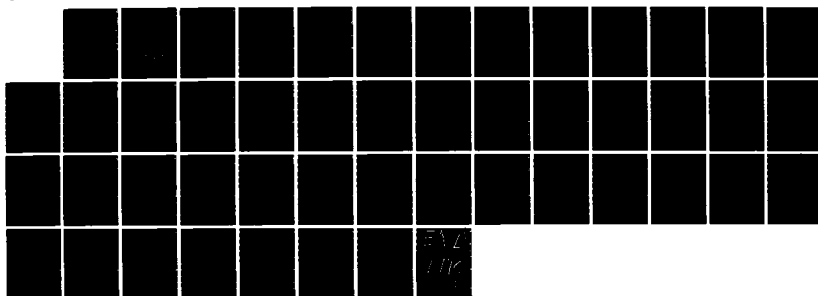
ESTABLISHMENT OF PRODUCTION LINE FOR MANUFACTURE OF  
40-MM HEDP M430 BODY ASSEMBLY(U) AMRON CORP WAUKESHA WI  
R FORT ET AL. MAY 86 ARCCD-CR-86003 DAAK10-82-C-8257

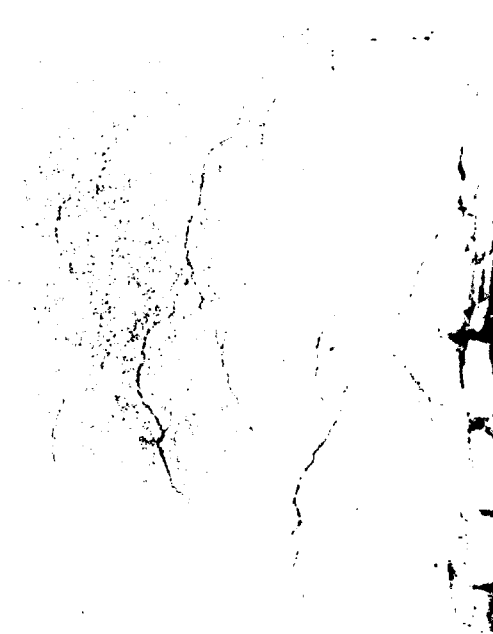
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CONTRACTOR REPORT ARCCD-CR-86003

**ESTABLISHMENT OF PRODUCTION LINE FOR  
MANUFACTURE OF 40-MM HEDP M430 BODY ASSEMBLY**

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MAY 30 1986

**MAY 1986**



**U. S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT CENTER**

**CLOSE COMBAT ARMAMENT CENTER**

**DOVER, NEW JERSEY**

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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9. PERFORMING ORGANIZATION NAME AND ADDRESS Amron Corporation 525 Progress Avenue Waukesha, WI 53186		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  A fully automated production line with the capacity to produce 140,000 body assemblies per month on a 1-8-5 basis was established. A demonstration test was performed to determine the actual production capability.		

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## 1. INTRODUCTION

### 1.1. FACILITY PROJECT OBJECTIVE

Amron Corporation set up a body assembly production facility with the capability of 140,000 M430 body assemblies per month on a 1-8-5 basis, as stated in Contract DAAK10-82-C-0257.

As a requirement of this contract, a demonstration test was performed to determine actual production capacity.

Amron demonstrated this production capacity on hardware Contract DAAK10-84-C-0195.

Amron demonstrated to the Government the capability on those pieces of equipment procured under this contract.

### 1.2. MANUFACTURING FACILITY DEVELOPMENT

Debugging of the production machinery began in February of 1983 and was completed in September of 1983. Volume body assembly production began in September of 1983. Debugging of automation then proceeded and was completed in May of 1985. The Demonstration Test was conducted from July 8, 1985 to July 12, 1985.

### 1.3. MANUFACTURING PROCESS SUMMARY

The M430 projectile body is manufactured from 1009 cold rolled strip stock. The stock is blanked, drawn, and the boattail is formed in mechanical press operations. The I.D. thread and band groove is machined into the body, followed by the crimping of the copper band to the body. The band is machined and the body assembly is phosphate coated and painted.

## 2. PROCESS DESCRIPTION

### 2.1. FLOW PROCESS DIAGRAM

A simplified flow process diagram is provided (Exhibit I) indicating each step in the body assembly production manufacturing sequence by operation title and number. Also, this diagram includes inprocess inspection stations and material handling modes.

### 2.2. MANUFACTURING PROCESS DESCRIPTION

The manufacturing process description is identified for each production manufacturing sequence as shown on the simplified flow process diagram (Exhibit I) and individual process description sheets (Exhibit II).



### 3. SUMMARY OF DEBUG TESTING

#### 3.1. OBJECTIVE

To evaluate the equipment, manufacturing procedures, inspection procedures, and set-up and calibration procedures for the M430 body assembly line and modify or correct as necessary. This was done while the M430 was in production. Quality of body assemblies produced, as well as personnel talents and equipment performance, had been established based on government acceptance of M430 body assemblies prior to shipment to the Army Ammunition Plant.

#### 3.2. MANAGEMENT

Ray Foat - Senior Project Engineer

Overall project responsibility including production manufacturing process development, equipment and tooling selections.

Paul R. Sherman - Quality Control Engineer

Overall quality assurance project responsibility for all gaging and testing procedures used in the manufacturing of the M430 body assembly. This responsibility also dictated that in process controls be established on all production operations.

James Tullius - Production Manager

Overall production responsibility by providing competent personnel and supervision to set-up, debug and operate all production equipment provided under this project.

This debugging cycle had been accomplished prior to demonstration test based on the fact that all equipment provided under this project was in production use to manufacture M430 body assemblies for shipment to the U. S. Government.

### 3.3. SCHEDULE

The debugging cycle was performed on Amron's floor prior to the equipment release to production. This debugging phase has been completed on all manufacturing operations.

### 3.4. COST

All costs associated with the debugging cycle have been awarded under Amron's facility contract DAAK10-82-C-0257, CLIN 0001 for subject project.

### 3.5. DATA COLLECTION

Data collected and recorded during the debugging cycle consisted of equipment and quality problems, analyses of these problems, and the corrective action(s) taken.

Equipment purchase description specifications were used

### 3.5. DATA COLLECTION (Cont'd)

in determining the final acceptance of this equipment.  
Corrective action was performed by the equipment vendor  
or Amron's personnel depending on responsibility.

### 3.6. GOVERNMENT SUPPORT

Government furnished material/government furnished  
equipment:

<u>Oper. No.</u>	<u>Description</u>	<u>Equipment</u>
100	Grind	#2 Cincinnati Centerless Gov't. I.D. No. 3415-21395
130	Bore, Face & Tap	1-1/4" RA-6 National Acme Gov't. I.D. No. 3416-30122 Gov't. I.D. No. 3416-30123 Gov't. I.D. No. 3416-29370 Gov't. I.D. No. 3416-29367
20	Assemble Band	8 Ton Denison Press Gov't. I.D. No. 3442-05261 Gov't. I.D. No. 3442-05262 Gov't. I.D. No. 3442-05564
30	Machine Band & Boattail	#52 New Britain Gov't. I.D. No. 3416-36507 Gov't. I.D. No. 3416-36508
70	Paint I.D.	Spraymation Gov't. I.D. No. US-01-B-2430

Government facilities or services: None required.

### 3.7. SUMMARY OF RATE BUILDUP ATTAINED DURING DEBUG TESTING

Sept. 1983	15,000
Oct. 1983	16,000
Dec. 1983	22,000
Jan. 1984	44,000
Mar. 1984	118,000
Apr. 1984	56,000
May 1984	105,000
June 1984	96,000
July 1984	120,000
Aug. 1984	150,000
Sept. 1984	200,000

## 4. DEMONSTRATION PLAN

### 4.1. OBJECTIVE

To demonstrate to the U. S. Government that Amron Corporation, Waukesha, Wisconsin, has successfully installed a production line for the M430 body assembly with a capacity of 140,000 units per month on a 1-8-5 hours per month basis.

### 4.2. PRODUCTION REQUIREMENTS

Each piece of production equipment assigned to this project and listed in Exhibit III was demonstrated by producing a minimum of 30,113 acceptable M430 body assemblies in

thirty-five (35) hours. All equipment necessary to support the prove-out of a manufacturing operation, regardless of ownership or origin, was operated during the demonstration of that operation.

#### 4.3. EQUIPMENT MAINTENANCE PROGRAM

4.3.1. Amron's maintenance policy for the M430 body assembly manufacturing line provides for periodic production equipment shutdown. Shutdown is scheduled after the need for repair has been identified by the manufacturing department and assessment has been made by in-house maintenance personnel. The equipment shutdown schedule is determined by two (2) main factors: length of equipment downtime needed for this repair and the size of the storage bank needed at this operation to comply with contractual delivery schedule.

If an equipment failure requires an excessive amount of time to repair, Amron's maintenance policy includes the use of alternate production equipment from other product lines. This is permitted provided that the replacement piece of equipment is compatible with the production operation and minimal changeover time is required, also authorization for use is received from the PCO.

4.3.2. The individual manufacturing operations shown on Exhibit I (Process Flow Diagram) and Exhibit II (Process Description Sheets) identify the maintenance effort to be performed on the equipment and associated tooling. This effort is defined as follows:

- Preventive Maintenance Schedule
- Manuals
- Records/Documentation
- Spare Parts

4.3.3. The Amron Corporation did not plan to demonstrate any maintenance tasks during this test program. If any equipment failure had been realized during this period, Amron's standard maintenance program would have been used.

#### 4.4. ENVIRONMENTAL CONSIDERATIONS

The Amron Corporation has one (1) manufacturing process, used in the production of the M430 body assembly, that is under State and Federal environmental controls.

OPERATION NUMBER 80, PAINT I.D. AND O.D.

Equipment: Binks Auto Spray System.

Controls:

Air	- NR154 Air Pollution Control
Water	- Federal Pretreatment Regulations - 40 CFR Part 413, 433
Hazardous Waste	- Federal Regulations 3004 of RCRA. State Regulations NR181 - Hazardous Waste Management Rule

4.5. SCHEDULE

The demonstration test schedule was as shown on Exhibit IV, Demonstration Test Dates.

4.6. GOVERNMENT SUPPORT

4.6.1. Government Furnished Material (GFM)	No additional Government furnished items were required in preparation or performance of this test.
Government Furnished Equipment	
4.6.2. Government Furnished Facilities	No additional Government furnished items were required in preparation or performance of this test.
Government Furnished Services	

#### 4.7. PERSONNEL REQUIREMENTS

4.7.1. Personnel required for performance of this demonstration test have been categorized by work function. The distribution of personnel is shown below:

<u>Personnel Category</u>	<u>Personnel Qty.</u>
Production (Set-up & Operators)	11
Inspection (Patrol & Line)	6
Laboratory (Tool & Gage, Chemical)	2
Maintenance (tooling & Equipment)	2
Support (Receiving, Shipping & Stores)	1
Supervision	<u>2</u>
	24

4.8. Contractual data item requirements for the M430 facility are as defined on the DD Form 1423 incorporated in Contract DAAK10-82-0257. These data item requirements are defined below:

<u>Sequence No.</u>	<u>Description of Data</u>
A001	Final Technical Report
A002	Purchase Description
A003	Project Status Report
A004	Operational Baseline Listing



4.8. (Cont'd.)

<u>Sequence No.</u>	<u>Description of Data</u>
A005	Commerical Computer and Peripheral Equipment Manuals
A006	Instruction Manuals
A007	Demonstration Test Plan
A008	Drawings, Engineering Associated Lists
A009	Provisioning & Other Procurement Screening Data
A010	Subproject Funding Report
A011	Letter Progress Reports
A012	Equipment History Data Package
A013	Inspection System Program Plan
A014	Quality Inspection Test Demonstration and Evacuation Report
A015	Quality Inspection Test Demonstration and Evacuation Report
A016	Quality Inspection Test Demonstration and Evacuation Report
A017	Ammunition Data Card
A018	Utility Inspection Unserviceable Material Report
A019	Quality Engineering Inspection
A020	Equipment Description Documentation
A021	Quality Inspection Defect Report
A022	Defense Priorities and Allocations
A023	Defense Priorities and Allocations
A024	ECP's and RFD/W's (Short Form)
A025	Bills of Material

#### 4.9. DEMONSTRATION TEST EVALUATION

4.9.1. Representatives from the Engineering and Quality Assurance Departments assisted in evaluating the results of this demonstration test.

Government personnel involved in test evaluation represented the following agencies:

ARRADCOM	-	Dover, New Jersey
P.B.M.	-	Dover, New Jersey
DCAS	-	Milwaukee, Wisconsin

4.9.2. Conventional mathematics were used for the conversion and analysis of the test data. The ability of Amron to produce acceptable product at the required rates is exhibited by the data collected.

4.9.3. Amron's ability to produce at the stated manufacturing rate was demonstrated by the data collected during the test and provides the basis of line acceptance.

## 5. DEMONSTRATION TEST

### 5.1. TEST DESCRIPTION

Amron Corporation demonstrated to the U. S. Government the capability of 140,000 units on a 1-8-5 basis, for the M430 body assembly production line as stated in Contract DAAK10-82-C-0257.

This demonstration test was performed in the presence of the following Government representatives:

Mr. Paul Ng  
US Army PBMA  
Dover, New Jersey

The production run was performed to insure the capability of each operation at the rate specified by the Government.

Amron demonstrated the awarded capacity using hardware provided under Contract DAAK10-84-C-0195.

The Demonstration Test Schedule is shown on Exhibit IV.

During this demonstration, Amron maintained detailed records on each operation.

These records included as a minimum:

- a) Number of parts produced.
- b) Number of parts scrapped.
- c) Test start and stop time.
- d) Cause of excessive downtime.
- e) Average daily production rate.

Thirty-five or fewer hours, with a minimum of 30,113 parts, were run at each operation. Each piece of equipment in the line was demonstrated in the test.

Machine downtime due to waiting for parts from a previous operation was termed administrative downtime.

## 5.2. DATA ANALYSIS

5.2.1. Failure data were recorded on the Prove-Out Data Collection Sheet. Notations on the sheets did not require further definition.

5.2.2. Production data were collected from part counters at mechanical operations. These same counts were used for subsequent finishing operations since the

same piece parts were run through all machines in a series with no accumulation in-between. Times were recorded by an observer with a stop watch.

5.2.3. Quality data were collected by charts which are a normal part of the Amron Quality Control System. Out of tolerance parts were normally produced during machine adjustments and counted by the set-up person.

#### 5.3. DEMONSTRATION TEST SUMMARY

Analysis results are listed under Exhibit V.

#### 5.4. PROBLEM AREAS

1. No product quality problems were encountered during the test.
2. One mechanical problem was encountered. The clutch on one (1) New Britain, Operation #30, machine band, failed and had to be replaced.

#### 5.5. CONCLUSIONS

The demonstration run did net 100% of the awarded line capacity. These parts became the property of the Government through the current hardware contract and became part of the deliverable quantities.

Amron demonstrated the capability of the manufacturing operations to meet the (stated) rate by producing a minimum of 30,113 acceptable body assemblies in 35 hours at each operation. All equipment necessary to support the prove-out of an operation, regardless of ownership or origin, was operated during the demonstration of that operation.

The ability to produce at the stated rate as evidenced by the data collected formed the basis of line acceptance.

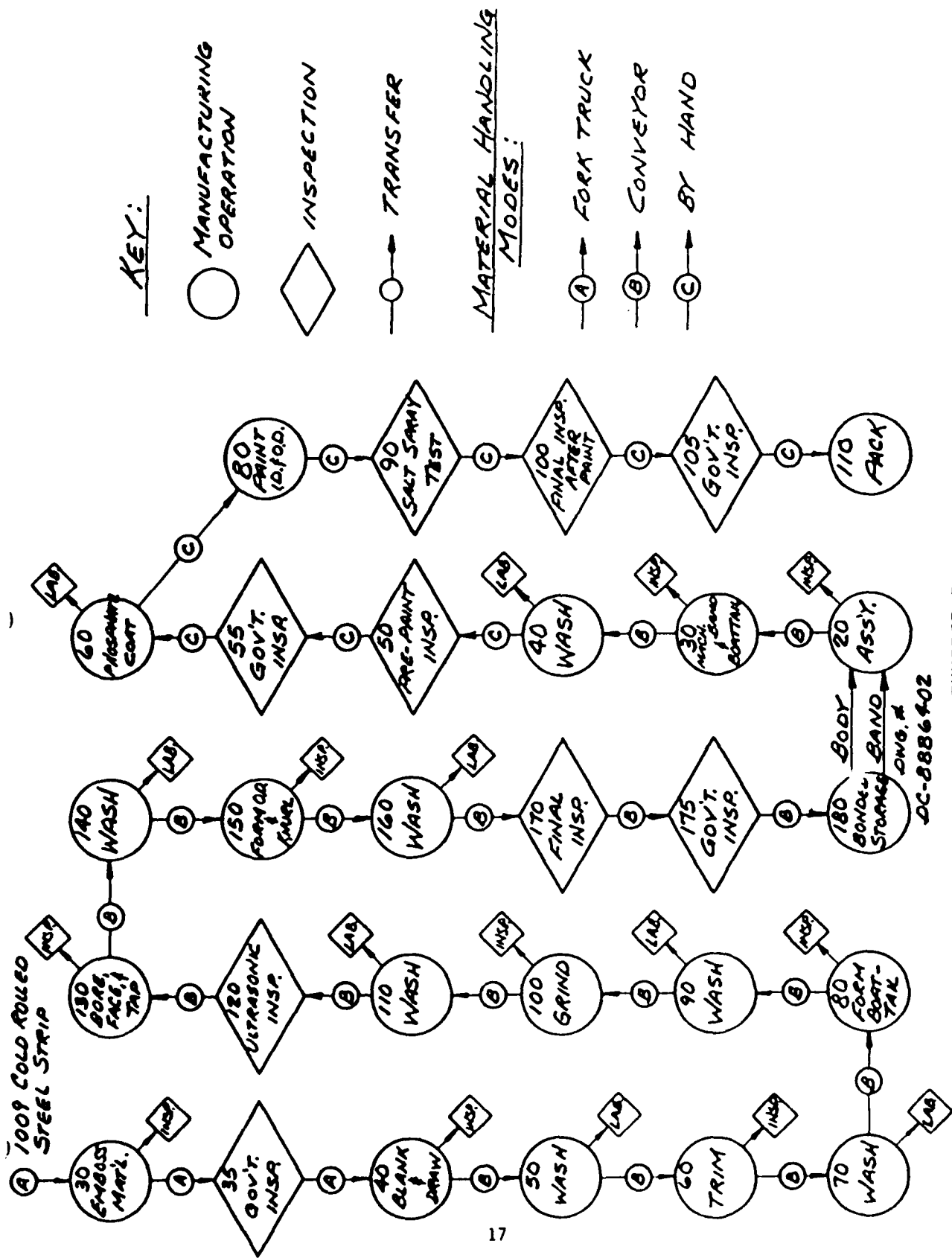


EXHIBIT I

DC-8886402

PROCESS DESCRIPTION

Operation Number: 30 (Body)

Operation Description: Emboss a pattern on one side of strip steel coil material in a rolling mill; the strip steel is .138 + .003 thick x 7.750 + .016 wide x 48" max. O.D. x 16" I.D.

Operation Characteristic: Embossing the desired pattern configuration by the cold rolling process.

Equipment Description: Fenn, 2-high single stand 10" rolling mill model #101 w/take-up reel. Year of Mfg. 1965.

Equipment Warranties: Expired.

Calibration Requirements: Web thickness, overall thickness.

Inspection Requirements: (15) measurements taken on each sample specimen. Pattern is checked after each rolling tool change.

Certification Requirements: Material: Yes Personnel: In-house

Manpower Requirements: Set-up: 1/2 man Line Inspector: 1/4 man  
Utility: 1/8 man Patrol Inspector: 1/8 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: None.

Preventive Maintenance Schedule: Yes - Lubricated.

Manuals: Operating \_\_\_\_\_ Maintenance Yes

Record/Documentation: Work Order System.

Spare Parts: Bearings, smooth roll, engraved roll



PROCESS DESCRIPTION

Operation Number: 40 (Body)

Operation Description: Feed coiled strip steel to transfer die. First station blanks a disc, blank is moved through (5) draw stations by a mechanical transfer mechanism.

Operation Characteristic: Blank, (5) five draws.

Equipment Description: 300 ton Warco mechanical press with air cushion. Year of mfg. 1962, 1964.

Equipment Warranties: Expired.

Calibration Requirements: Draw lubrication, strip steel feeder.

Inspection Requirements: (3) three different dimensional checks (3 pieces per press per hour).

Certification Requirements: Material: \_\_\_\_\_ Personnel: In-house

Manpower Requirements: Patrol Inspector: 1/4 man Set-up: 3/8 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Oil recovery system.

Preventive Maintenance Schedule: Lubrication: Yes  
Mechanical: As required

Manuals: Operating \_\_\_\_\_ Maintenance Yes

Record/Documentation: In process control charts, work order -  
Maintenance.

Spare Parts: Blanking punches & dies  
Draw punches, dies & knockout  
Drive belts

PROCESS DESCRIPTION

Operation Number: 50 (Body)

Operation Description: Drawn parts are fed from blank & draw operation through the spiral drum type washer.

Operation Characteristic: Alkaline clean, water rinse.

Equipment Description: Metalwash (3) stage horizontal spiral drum washer. Year of mfg. 1960.

Equipment Warranties: Expired.

Cal oration Requirements: Drum speed, steam pressure, tank temperatures.

Inspection Requirements: Part cleanliness.

Certification Requirements: Material: \_\_\_\_\_ Personnel: In-house

Manpower Requirements:

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventive Maintenance Schedule: As required.

Manuals: Operating \_\_\_\_\_ Maintenance \_\_\_\_\_

Record/Documentation: Work Order System - Maintenance  
- Lab Service

Spare Parts: Temperature controls  
Pump repair parts  
Trunion rings & wheels

PROCESS DESCRIPTION

Operation Number: 60 (Body)

Operation Description: Parts are feeder bowl fed to screw machine and indexed to trim and chamfer on I.D. and O.D.

Operation Characteristic: Trim to length.

Equipment Description: National Acme 2-3/8" HSC-6, 6 spindle, high speed, chucking machine.

Equipment Warranties: 12 months from date of delivery.

Calibration Requirements:

Inspection Requirements: Overall length  
Frequency: 6 pieces every hour

Certification Requirements: Material: \_\_\_\_\_ Personnel: In-house

Manpower Requirements: Patrol Inspector: 1/4 man  
Set-up: 2/3 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: None.

Preventive Maintenance Schedule: Lubrication: Yes  
Mechanical: As Required

Manuals: Operating Yes Maintenance Yes

Record/Documentation: Work Order System - Maintenance

Spare Parts: Cutting Tools, Tool Holders, Collets, Spindle Bearings

PROCESS DESCRIPTION

Operation Number: 70 (Body)

Operation Description: Parts are fed from trim operation through the spiral drum type washer.

Operation Characteristic: Alkaline clean, water rinse.

Equipment Description: Ransohoff (2) stage horizontal spiral drum washer. Year of Mfg. 1952.

Equipment Warranties: Expired.

Calibration Requirements: Drum speed, steam pressure, tank temperatures.

Inspection Requirements: Part cleanliness.

Certification Requirements: Material: \_\_\_\_ Personnel: In-house

Manpower Requirements:

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventive Maintenance Schedule: As required.

Manuals: Operating \_\_\_\_ Maintenance \_\_\_\_

Record/Documentation: Work Order System - Maintenance  
- Lab Service

Spare Parts: Temperature controls  
Pump repair parts  
Trunion rings and wheels

PROCESS DESCRIPTION

Operation Number: 80 (Body)

Operation Description: Parts are feeder bowl fed to die which forms the boattail area.

Operation Characteristic: Form boattail.

Equipment Description: 175 ton Verson press with air cushion. Year of Mfg. 1952, 1969.

Equipment Warranties: Expired.

Calibration Requirements: Slide adjustment, cushion pressure, part lubrication, nitrogen pressure, part feeder.

Inspection Requirements: (7) different dimensional checks.  
Frequency: 5 parts per press every 30 minutes.

Certification Requirements: Material:      Personnel: In-house

Manpower Requirements: Patrol Inspector: 1/4 man  
Set-up: 1/2 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Oil recovery system.

Preventive Maintenance Schedule: Lubrication: Yes  
Mechanical: As required.

Manuals: Operating      Maintenance Yes

Record/Documentation: In process control charts  
Work Order System - Maintenance

Spare Parts: Punches  
Dies  
Knockouts  
Drive Belts

PROCESS DESCRIPTION

Operation Number: 90 (Body)

Operation Description: Parts are controlled from the discharge end of the boattail presses and automatically fed through the belt type spray washer and dried at the exit end.

Operation Characteristic: Alkaline clean, water rinse and dry.

Equipment Description: (2) stage clean, rinse, and dry spray washer with mesh belt conveyor system. Year of Mfg. 1982.

Equipment Warranties:

Calibration Requirements: Belt speed, tank temperatures, water rinse flow and drier temperature.

Inspection Requirements: Part cleanliness.

Certification Requirements: Material: \_\_\_\_ Personnel: In-house

Manpower Requirements:

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventive Maintenance Schedule: As required.

Manuals: Operating \_\_\_\_ Maintenance \_\_\_\_

Record/Documentation: Work Order System - Maintenance  
- Lab Service

Spare Parts: Temperature Controls  
Pump Repair Parts

PROCESS DESCRIPTION

Operation Number: 100 (Body)

Operation Description: Parts are controlled from discharge end of washer and automatically fed to a thru feed centerless grinder for finishing the outside diameter.

Operation Characteristic: Grind outside diameter.

Equipment Description: Cincinnati Milacron centerless thru feed grinder. Year of Mfg. 1952.

Equipment Warranties: Expired.

Calibration Requirements: Dress grinding and regulating wheels, adjust for size.

Inspection Requirements: Outside diameter dimensional check.  
Frequency: 5 parts every 30 minutes from each machine.

Certification Requirements: Material: \_\_\_\_\_ Personnel: In-house

Manpower Requirements: Patrol Inspector: 1/4 man  
Set-up: 1/2 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Central coolant system.

Preventive Maintenance Schedule: Lubrication: Yes  
Mechanical: As required.

Manuals: Operating \_\_\_\_\_ Maintenance \_\_\_\_\_

Record/Documentation: In process control charts  
Work order system - Maintenance

Spare Parts: Grinding wheel  
Regulating wheel  
Work rest blade

PROCESS DESCRIPTION

Operation Number: 110 (Body)

Operation Description: Parts are controlled from the discharge end of the centerless grinders and automatically fed through the belt type spray washer and dried at the exit end.

Operation Characteristic: Alkaline clean, water rinse and dry.

Equipment Description: (2) stage clean, rinse, and dry spray washer with mesh belt conveyor system. Year of Mfg. 1982.

Equipment Warranties:

Calibration Requirements: Belt speed, tank temperatures, water rinse flow and drier temperature.

Inspection Requirements: Part cleanliness.

Certification Requirements: Material:      Personnel: In-house

Manpower Requirements:

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventive Maintenance Schedule: As required.

Manuals: Operating      Maintenance     

Record/Documentation: Work Order System - Maintenance  
- Lab Service

Spare Parts: Temperature Controls  
Pump Repair Parts 120



PROCESS DESCRIPTION

Operation Number: 120 (Body)

Operation Description: Parts are controlled from discharge end of washer and automatically fed to an indexing mechanism, which positions the part at the test stations. Five (5) different ultrasonic tests are performed on each part and then the part is automatically discharged to an accept or reject chute.

Operation Characteristic: Inspection for cracks and voids.

Equipment Description: IMPCO vertical dial indexing machine with rotating spindles, and ultrasonic instrumentation. Year of Mfg. 1982.

Equipment Warranties: Expired.

Calibration Requirements: Daily, using standards manufactured to requirements specified on Government drawing 8869822.

Inspection Requirements: Nine (9) standards are introduced every half hour, 100% rejection is required.

Certification Requirements: Material: \_\_\_\_\_  
Personnel: Outside Schooling

Manpower Requirements: Tool & Gage: 1 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: None.

Preventive Maintenance Schedule: Operation: Yes  
Mechanical: As required.

Manuals: Operating Yes Maintenance \_\_\_\_\_

Record/Documentation: Processing Standards: Recorded  
Work Order System: Maintenance

Spare Parts: Transducers  
Instrumentation  
Spindles

PROCESS DESCRIPTION

Operation Number: 130 (Body)

Operation Description: Parts are controlled from accept chute of ultrasonic machine and automatically fed to screw machine and indexed to chamfer, face, bore, undercut, tap and automatically unloaded.

Operation Characteristic: Bore, face, groove, chamfer and tap open end of part.

Equipment Description: 1-1/4" RA-6 National Acme, 6 Spindle chucking machine. Year of Mfg. 1954.

Equipment Warranties: Expired.

Calibration Requirements:

Inspection Requirements: (13) dimensional checks  
Frequency: (6) pieces per machine  
every 30 minutes.

Certification Requirements: Material:      Personnel: In-house

Manpower Requirements: Patrol Inspector: 1/2 man  
Set-up: 2 men

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: None.

Preventive Maintenance Schedule: Lubrication - Yes  
Mechanical - As required.

Manuals: Operating Yes Maintenance Yes

Record/Documentation: In process control charts  
Work Order System - Maintenance

Spare Parts: Cutting Tools, Collets, Tool holders,  
Spindle bearings.

PROCESS DESCRIPTION

Operation Number: 140 (Body)

Operation Description: Parts are controlled from the discharge end of the bore, face and tap machines and automatically fed through the belt type spray washer and dried at the exit end.

Operation Characteristic: Alkaline clean, water rinse and dry.

Equipment Description: (3) stage clean, rinse, and dry spray washer with mesh belt conveyor system. Year of Mfg. 1982.

Equipment Warranties: Expired.

Calibration Requirements: Belt speed, tank temperatures, water rinse flow and drier temperature.

Inspection Requirements: Part cleanliness.

Certification Requirements: Material: \_\_\_\_ Personnel: In-house

Manpower Requirements:

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Outside Air Vent

Preventive Maintenance Schedule: As required.

Manuals: Operating \_\_\_\_ Maintenance \_\_\_\_

Record/Documentation: Work Order System - Maintenance  
- Lab Service

Spare Parts: Temperature Controls  
Pump Repair Parts

PROCESS DESCRIPTION

Operation Number: 150 (Body)

Operation Description: Parts are controlled from discharge end of washer and automatically fed to screw machine and indexed to form and shave band grooves, to knurl and trim knurl, and automatically unload.

Operation Characteristic: Form band groove and knurl.

Equipment Description: 2-3/8" HSC-6 6 spindle, high speed, chucking machine. Year of Mfg. 1983.

Equipment Warranties: 12 months from date of delivery.

Calibration Requirements:

Inspection Requirements: (5) dimensional checks  
Frequency: (6) pieces every 30  
minutes

Certification Requirements: Material:        Personnel: In-house

Manpower Requirements: Patrol Inspector: 1/4 man  
Set-up: 2/3 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: None.

Preventive Maintenance Schedule: Lubrication: Yes  
Mechanical: As required.

Manuals: Operating Yes Maintenance Yes

Record/Documentation: In process control charts  
Work Order System - Maintenance

Spare Parts: Cutting Tools, Collets, Tool Holders,  
Spindle Bearings

PROCESS DESCRIPTION

Operation Number: 160 (Body)

Operation Description: Parts are controlled from the discharge end of band groove and knurl machine and automatically fed through the belt type spray washer and dried at the exit end.

Operation Characteristic: Alkaline clean, water rinse and dry.

Equipment Description: (3) stage clean, rinse, and dry spray washer with mesh belt conveyor system. Year of Mfg. 1982.

Equipment Warranties: Expired.

Calibration Requirements: Belt speed, tank temperatures, water rinse flow and drier temperature.

Inspection Requirements: Part cleanliness.

Certification Requirements: Material: \_\_\_\_ Personnel: In-house

Manpower Requirements:

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Outside Air Vent.

Preventive Maintenance Schedule: As required.

Manuals: Operating \_\_\_\_ Maintenance \_\_\_\_

Record/Documentation: Work Order System - Maintenance  
- Lab Service

Spare Parts: Temperature Controls  
Pump Repair Parts

PROCESS DESCRIPTION

Operation Number: 20 (Body Assembly)

Operation Description: Parts are controlled from discharge end of washer and automatically fed to a dial index table. Rotating bands are feeder bowl fed to the index table. Bands are assembled to bodies and automatically unloaded.

Operation Characteristic: Assemble band to body.

Equipment Description: 8 ton Denison hydraulic press with dial index table. Year of Mfg. 1953.

Equipment Warranties: Expired.

Calibration Requirements:

Inspection Requirements: (2) dimensional checks  
Frequency: (5) pieces every hour per machine.

Certification Requirements: Material: \_\_\_\_\_ Personnel: In-house

Manpower Requirements: Patrol Inspector: 3/8 man  
Set-up: 2/3 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: None.

Preventive Maintenance Schedule: Lubrication: Yes  
Mechanical: As required.

Manuals: Operating \_\_\_\_\_ Maintenance \_\_\_\_\_

Record/Documentation: In Process Control Charts  
Work Order System - Maintenance

Spare Parts: Holding Fixtures, Draw Dies, Air Cylinders

PROCESS DESCRIPTION

Operation Number: 30 (Body Assembly)

Operation Description: Parts are controlled from discharge end of band assembly machines and automatically fed to screw machine and indexed to rough and finish form band, boattail and groove, face end of boattail and automatically unload.

Operation Characteristic: Machine band and boattail.

Equipment Description: Model #52, 6-spindle, New Britain chucking machine. Year of Mfg. 1969.

Equipment Warranties: Expired.

Calibration Requirements: (12) dimensional checks.  
Frequency: (6) pieces per machine  
every 30 minutes.

Inspection Requirements:

Certification Requirements: Material: \_\_\_\_ Personnel: In-house

Manpower Requirements: Patrol Inspector: 1/4 man  
Set-up: 2/3 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: None.

Preventive Maintenance Schedule: Lubrication: Yes  
Mechanical: As required.

Manuals: Operating Yes Maintenance Yes

Record/Documentation: In Process Control Charts  
Work Order System - Maintenance

Spare Parts: Cutting Tools, Tool Holders, Collets

PROCESS DESCRIPTION

Operation Number: 40 (Body Assembly)

Operation Description: Parts are controlled from the discharge end of the machining of band and boattail and automatically fed through the belt type spray washer and dried at the exit end.

Operation Characteristic: Alkaline clean, water rinse and dry.

Equipment Description: (3) stage clean, rinse, and dry spray washer with mesh belt conveyor system. Year of Mfg. 1982.

Equipment Warranties:

Calibration Requirements: Belt speed, tank temperatures, water rinse flow and drier temperature.

Inspection Requirements: Part cleanliness.

Certification Requirements: Material: \_\_\_\_ Personnel: In-house

Manpower Requirements:

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventive Maintenance Schedule: As required.

Manuals: Operating \_\_\_\_ Maintenance \_\_\_\_

Record/Documentation: Work Order System - Maintenance  
- Lab Service

Spare Parts: Temperature Controls  
Pump Repair Parts



PROCESS DESCRIPTION

Operation Number: 60 (Body Assembly)

Operation Description: Parts are taken from discharge end of washer and placed in baskets. The baskets are placed in a drum on the tank line. The drum is then immersed in a series of tanks containing liquids for phosphate coating.

Operation Characteristic: Strip, clean, condition, phosphate and rinse.

Equipment Description: Special designed multiple tank line, with hoist.

Equipment Warranties: Expired.

Calibration Requirements: Tank analysis - temperature, concentration and material make-up.

Inspection Requirements: Phosphate coating weight test in accordance with TT-C-490. Frequency: (3) test panels every (4) hours.

Certification Requirements: Material:      Personnel: In-house

Manpower Requirements: Set-up: 3/4 man  
Utility: 1/8 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventive Maintenance Schedule:

Manuals: Operating Yes Maintenance     

Record/Documentation: Work Order System: Maintenance  
Process Control: Laboratory

Spare Parts: Heating coils  
Electrical components

PROCESS DESCRIPTION

Operation Number: 80 (Body Assembly)

Operation Description: Parts are hand loaded into fixtures on a continuous running paint line. Parts run through the spray paint booth and a drying section. They are then hand unloaded and placed in boxes.

Operation Characteristic: Paint inside and outside of parts, except band.

Equipment Description: Binks auto spray line.

Equipment Warranties: Expired.

Calibration Requirements:

Inspection Requirements: (1) dimensional check, visual of paint coverage and salt spray test.

Certification Requirements: Material: \_\_\_\_ Personnel: In-house

Manpower Requirements: Operator: 2 men  
Set-up: 1/2 man Utility: 1/8 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Air vent.

Preventive Maintenance Schedule: Lubrication: Yes  
Mechanical: As required

Manuals: Operating \_\_\_\_ Maintenance \_\_\_\_

Record/Documentation: Work Order System - Maintenance

Spare Parts: Paint guns and tanks  
Holding fixtures

EQUIPMENT DEMONSTRATED FOR 140,000/MO. CAPABILITY

OPER. NO.	OPERATION DESCRIPTION	EQUIPMENT DESCRIPTION	AMRON TAG NO.	OWNERSHIP GOV'T. FURNISHED OR CONTRACTOR	EQUIP. CYCLE RATE 100% EFFICIENT PARTS PER HOUR	RATE TO BE DEMONSTRATED PARTS PER HOUR
30	Emboss Coil	Fenn 10" Rolling Mill Mod. #101 W/Take-up Reel	1979	GFM	5,000	4,000
32	Emboss Inspection					
35	Government Inspection					
40	Blank & Draw	300 Ton Warco Press, with Air Cushion & Zig-Zag Feed (2 required)	4016 4077	GFM GFM	1,080 1,080	1,404
45	Draw Inspection					
50	Wash	Metalwash (3) Stage Horizontal Spiral Drum Washer	368	GFM	5,000	1,404
60	Trim	2-3/8" HSC-6, 6 Spindle, High Speed, Chucking Machine	4202	GFM	2,416	1,690
65	Trim Inspection					
70	Wash	Ransohoff (2) Stage Horizontal Spiral Drum Washer	1655	GFM	5,000	1,690
80	Form Boattail	175 Ton Verson Mechanical Press with Air Cushion (2 required)	4020 4022	GFM GFM	2,640 2,640	868
85	Boattail Inspection					
90	Wash	Advance Curing (2) Stage, Clean, Rinse & Dry Spray Washer with Mesn Belt Conveyor System	5049	GFM	1,500	868

EXHIBIT III

100	Grind	Cincinnati Milacron Centerless Thru Feed Grinder (2 required)	4001 4950	GFM GFM	720 720	868
105	Grind Inspection					
110	Wash	Advance Curing (2) Stage, Clean, Rinse & Dry Spray Washer with Mesh Belt Conveyor System	5049	GFM	1,500	868
120	Ultrasonic Inspection	IMPCO Vertical Dial Indexing Machine with Rotating Spindles & Krautkramer KB-6000 Instrumentation	5072	GFM	1,200	868
130	Bore, Face & Tap	1-1/4" RA-6 National Acme, 6 Spindle Chucking Machine (4 required)	4968 4980 5016 5017	GFM GFM GFM GFM	600 600 600 600	868
135	Bore, Face & Tap Inspect.					
140	Wash	Advance Curing (3) Stage, Clean, Rinse & Dry Spray Washer with Mesh Belt Conveyor System	5050	GFM	1,500	868
150	Form O.D. & Knurl	2-3/8" HSC-6, 6 Spindle, High Speed Chucking Machine	5069	GFM	1,550	868
155	O.D. & Knurl Inspection					
160	Wash	Advance Curing (3) Stage, Clean, Rinse & Dry Spray Washer with Mesh Belt Conveyor System	5050	GFM	1,500	868
170	Pre-Band Inspection					

EXHIBIT III

175	Government Inspection				
20	Assemble Band	Denison 8 Ton Hydraulic Press with Dial Index Table (3 required)	4953 4954 4955	GFM GFM GFM	960 960 960
25	Band Inspection				868
30	Machine Band & Boattail	New Britain Model #52, 6 Spindle, Chucking Machine (2 required)	4951 4952	GFM GFM	1,320 1,320
35	Machine Band & Boattail Inspection				868
40	Wash	Advance Curing (3) Stage Rinse & Dry Spray Washer with Mesh Belt Conveyor System	5050	GFM	1,500
50	Pre-Paint Inspection				
55	Government Inspection				
60	Phosphate Coat	Special Design Multiple Tank Line with Hoist	2468	GFM	6,000
80	Paint I.D. & O.D.	Binks Continuous Running Auto Spray Line with Spray Booth	1822	GFM	1,620
90	Salt Spray Test				
100	Final Inspect After Paint				
105	Government Inspection				

DEMONSTRATION TEST SCHEDULE

M430 BODY ASSEMBLY

<u>Operation Number</u>	<u>Operation Description</u>	<u>Test Dates</u>
030	Emboss Material	7-8-85
040	Blank & Draw	7-8-85/7-10-85
050	Wash	7-8-85/7-10-85
060	Trim	7-8-85/7-10-85
070	Wash	7-8-85/7-10-85
080	Form Boattail	7-8-85/7-11-85
090	Wash	7-8-85/7-11-85
100	Grind	7-8-85/7-12-85
110	Wash	7-8-85/7-12-85
120	Ultrasonic Inspection	7-8-85/7-12-85
130	Bore, Face & Tap	7-8-85/7-12-85
140	Wash	7-8-85/7-12-85
150	Form O.D. & Knurl	7-8-85/7-11-85
160	Wash	7-8-85/7-11-85
020	Assemble Band	7-8-85/7-11-85
030	Machine Band & Boattail	7-8-85/7-11-85
040	Wash	7-8-85/7-11-85
060	Phosphate Coat	7-8-85/7-10-85
080	Paint I.D. & O.D.	7-8-85/7-11-85

# 5.5. DEMONSTRATION TEST SUMMARY

OP NO	OPERATION DESCRIPTION	MACHINES		OBSERVED AVAILABILITY	REJECT RATE	REQUIRED RATE	OBSERVED RATE
		QTY ON HAND	QTY IN TEST				
030	Emboss Material	1	1	1.000	0	66.66 P.P.M.	118.77
040	Blank & Draw	2	2	.920	.0071	11.7 P.P.M.	12.93
050	Wash	1	1	.892	.0073	11.7 P.P.M.	12.61
060	Trim	1	1	1.000	0	23.4 P.P.M.	83.12
070	Wash	1	1	.837	.0016	28.16 P.P.M.	30.05
080	Form Boattail	2	2	1.000	0	28.16 P.P.M.	83.24
090	Wash	1	1	.655	.0011	7.23 P.P.M.	20.57
100	Grind	2	2	.988	.0073	7.23 P.P.M.	20.22
110	Wash	1	1	1.000	0	14.46 P.P.M.	24.98
120	Ultrasonic Inspection	1	1	.845	.0024	7.23 P.P.M.	9.93
130	Bore, Face & Tap	4	4	.802	.0037	7.23 P.P.M.	9.16
140	Wash	1	1	1.000	0	14.46 P.P.M.	24.98
150	Form O.D. & Knurl	1	1	.873	.0024	14.46 P.P.M.	23.38
160	Wash	1	1	.746	.0231	3.62 P.P.M.	5.39
020	Assemble Band	3	3	.878	.0250	3.62 P.P.M.	6.70
030	Machine Band	2	2	.728	.0262	3.62 P.P.M.	5.12
040	Wash	1	1	.678	.0272	3.62 P.P.M.	4.79
060	Phosphate Coat	1	1	1.000	0	14.46 P.P.M.	25.0
080	Paint I.D. & O.D.	1	1	.873	.0016	14.46 P.P.M.	19.74
090	Wash	1	1	1.000	0	14.46 P.P.M.	25.0
100	Grind	2	2	.985	.0009	4.82 P.P.M.	13.0
110	Wash	1	1	.941	.0013	4.82 P.P.M.	14.61
120	Ultrasonic Inspection	1	1	1.000	.0005	4.82 P.P.M.	13.0
130	Bore, Face & Tap	4	4	.692	.0130	7.23 P.P.M.	13.60
140	Wash	1	1	1.000	.0057	7.23 P.P.M.	15.47
150	Form O.D. & Knurl	1	1	1.000	0	14.46 P.P.M.	25.0
160	Wash	1	1	.956	0	55.0 P.P.M.	31.9
020	Assemble Band	3	3	.814	.0056	21.66 P.P.M.	19.67

EXHIBIT V

# DISTRIBUTION LIST

Commander  
Armament Research and Development Center  
U.S. Army Armament, Munitions and  
Chemical Command  
ATTN: SMCAR-CCL (5)  
SMCAR-MSI (5)  
Dover, NJ 07801-5001

Commander  
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ATTN: AMSMC-PBM-MC(D)  
AMSMC-QAF(D)  
Dover, NJ 07801-5001

Administrator  
Defense Technical Information Center  
ATTN: Accessions Division (12)  
Cameron Station  
Alexandria, VA 22304-6145

Director  
U.S. Army Materiel Systems Analysis  
Activity  
ATTN: AMXSY-MP  
Aberdeen Proving Ground, MD 21005-5066

Commander  
Chemical Research and Development Center  
U.S. Army Armament, Munitions and Chemical  
Command  
ATTN: SMCCR-SPS-IL  
Aberdeen Proving Ground, MD 21010-5423

Commander  
Chemical Research and Development Center  
U.S. Army Armament, Munitions and Chemical  
Command  
ATTN: SMCCR-RSP-A  
Aberdeen Proving Ground, MD 21010-5423

Director  
Ballistic Research Laboratory  
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Aberdeen Proving Ground, MD 21005-5066



Chief  
Benet Weapons Laboratory, CCAC  
Armament Research and Development Center  
U.S. Army Armament, Munitions and Chemical  
Command  
ATTN: SMCAR-CCB-TL  
Watervliet, NY 12189-5000

Commander  
U.S. Army Armament, Munitions and  
Chemical Command  
ATTN: SMCAR-ESP-L  
Rock Island, IL 61299-6000

Director  
U.S. Army TRADOC Systems Analysis Activity  
ATTN: ATAA-SL  
White Sands Missile Range, NM 88002

END

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